San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102
T 415.554.3155
F 415.554.3161
TTY 415.554.3488

February 14, 2014

VIA EMAIL

California Coastal Commission
c/o Sea-Level Rise Working Group
45 Fremont Street, Suite 2000
San Francisco, CA 94105

RE: Comments on Public Review Draft, California Coastal Commission Sea-Level Rise Policy Guidance

Dear Sea-Level Rise Working Group,

The San Francisco Public Utilities Commission (SFPUC) appreciates the opportunity to comment on the California Coastal Commission's Draft Sea-Level Rise Policy Guidance (DG), dated October 14, 2013. These comments are intended to supplement and support comments provided by Roger Kim, Senior Advisor to San Francisco Mayor Edwin M. Lee. Our focus here is on a particular area of expertise at the SFPUC which is also a focus of the DG: the use of science in assessing vulnerability and planning adaptation to climate change.

The SFPUC is a Department of the City and County of San Francisco and is comprised of three essential 24/7 service utilities: Water, Power, and Sewer. We are the third largest public utility in California, working in seven California counties with a combined annual operating budget of over $850 million.

Climate change poses significant challenges to vital infrastructure, public health and safety, and resource management. Planning for climate change also challenges us to come up with new ways of making decisions – while we can no longer rely upon past practice, the nature of the future is also difficult to discern with precision. As the now-clichéd saying goes, "stationarity is dead." This means that the past climate is no longer representative of future climate.[1] An important corollary to this "new normal" is that the stationary record has not yet been replaced with anything remotely resembling it, with excursions outside our experience all but certain but the nature of those excursions not yet well understood.

The DG is a landmark document as it is among the first with the potential for direct regulatory impact seeking to guide local government planning and decisions associated with the effects of sea level rise (SLR). At the heart of

[1] Milly, P.C.D. et al. *Stationarity is Dead: Whither Water Management*, Science, 2008.

the DG, as with all processes relating to assessing and adapting to the effect of SLR, is the use of "best available science." We agree wholeheartedly with the DG's repeated emphasis that best available science should be the benchmark for this work. We have several concerns in regards to the use of science in the DG:

1. The DG does not accurately represent the key science conclusions of the National Research Council Report, the exclusive source of science cited in the DG.
2. The DG unadvisedly relies on a single source of information, the NRC Report.
3. The DG in places appears to prohibit the use of other important sources of best available science in the development of Local Coastal Programs (LCPs) and Coastal Development Permits (CDPs).
4. The DG, as a result of the above, provides decision makers with an unnecessarily wide array of SLR effects, making the planning and permitting environment more difficult for both permitees and the Commission.

Comment 1: The Guidance inappropriately relies on some of the science conclusions from the NRC report while ignoring others.

The DG cites only the more extreme bounding ranges of SLR presented in the NRC Report, but does not mention the SLR estimates and ranges that are presented by NRC as being most likely – the "projections." The bounding "ranges," as presented in Tables 1 and 3 of the DG, include SLR of 2-12" in 2030, 5-24" in 2050 and 17-66" in 2100.[2] In contrast, the NRC "projections" are 6" +/- 2" for 2030, 11" +/- 4" for 2050 and 36" +/- 10" for 2100. The projections are clearly presented in numerous places, often alongside the bounding ranges.[3] Generally, the "ranges" in the NRC Report represent extreme, or worst case, levels of SLR that *may* occur but are considered by scientists *less likely*, or perhaps unlikely, to occur. The projections are considered the most likely SLR effects we will see in the respective time period. The projections were developed using a middle range emissions scenario drawn from the 2007 IPCC 4th Assessment Report (A1B) to derive the steric component of SLR and an extrapolation of continued accelerating land ice melt (independent of emissions scenario) but without substantial loss of the West Antarctica ice sheets or catastrophic ice melt in Greenland for the most significant land ice component.[4] It is important to note that current observations do not indicate that this kind of catastrophic ice melt will occur in this century to an extent that will lead to the extreme high figures for SLR.[5] Finally, the NRC sea level rise projections and their uncertainty (the +/-

[2] All comments herein refer to SLR figures in the NRC report pertaining to the area between Cape Mendocino and the Mexican border.
[3] Including: Table 5.2 (p. 89); Figure 5.5 (p. 92); Table 5.3 (p. 96); Figure 5.10, pg 103; Figure S.1 (p. 5), which is repeated as Figure 5.9 (p. 102); and the narrative beginning on page 92.
[4] NRC Report, Table 5.2, p. 89, and Table 5.3, p. 96
[5] Pfeffer, W.T., et al. *Kinematic Constraints on Glacier Contributions to 21st-Century Sea-Level Rise,* Science, Vol 321 (2008). Also: *Climate Change 2013: The Physical Science Basis. Working Group 1 Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Summary for Policymakers.* 2013. p. 23-24. Intergovernmental Panel on Climate Change. Also: Personal communication, Tad Pfeffer (NRC Report co-author);

numbers) reflect one standard deviation,[6] meaning that the projections encompass 15%/85% confidence intervals. In other words, NRC Report authors considered it 70% likely that seas will rise *between 26" and 46"* (10" above and below the projection of 36") by the Year 2100, 15% likely it will rise *less than 26"* and 15% likely it will rise *more than 46."*

We are not suggesting that the bounding ranges be ignored. On the contrary, best and worst case scenarios are clearly needed in planning for a variety of reasons and in a variety of situations. But omitting the projections leaves out one of the critical – and valuable – science conclusions of the NRC report. Exclusively referencing the extremes will cause greater confusion for stakeholders and greater difficulty making thoughtful, prudent development and spending decisions. The bounding ranges, when presented alone, provide a bewildering, even paralyzing range of potential effects around which to plan and we are concerned this will have a deleterious effect on processes before the Commission.

We recognize that the State of California Sea-Level Rise Guidance Document (State Guidance)[7] omitted the more moderate projection estimates and ranges and therefore the Commission may feel constrained to do the same.[8] The State Guidance, however, specifically called out the importance of local considerations and approaches in the use of SLR projections in a flexible manner, providing the Commission with considerable latitude:

> Although the estimates of future SLR provided in this document are intended to enhance consistency across California state agencies, the document is not intended to prescribe that all state agencies use specific or identical estimates of SLR as part of their assessments or decisions. [9]

More important, we suggest that omitting substantive (not to mention useful) science conclusions in the NRC Report from the DG undermines the "best available science" advice to local governments that appears throughout the DG.

We are also concerned that the confoundingly wide range 17-66" for 2100 will get shorthanded to "66 inches." This is precisely what happened when the Rahmstorf semi-empirical projection of 21-55", the state-adopted range from the actual peer-review science ,[10] was shorthanded by the media, many agencies, and much of the public as simply "55 inches." Again, we are not suggesting that the extremes be taken off the table – relying on them exclusively, however, is what we call "catastrophizing," using only the worst case possible futures in decision making processes. In practice, this approach virtually assures that scientific information is used in a way that is most likely to be incorrect. In addition, we believe such an approach will make it

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[6] NRC Report, Table 5.2, p. 89, and Table 5.3, p. 96
[7] *State of California Sea-Level Rise Guidance Document. Developed by the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT), with science support provided by the Ocean Protection Council's Science Advisory Team and the California Ocean Science Trust. March 2013 Update.*
[8] We have been invited to provide similar comments to these to the Ocean Protection Council and Ocean Science Trust, who led development of the State Guidance.
[9] State Guidance, p. 1
[10] *2009 California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008.* California Natural Resources Agency. p. 15.

difficult for decision-makers to produce cost-effective and robust long-term strategies. The DG, in the very first paragraph, appears to initiate this potential reduction of the science when it states that "the National Research Council projected that sea level may rise by as much as 140-165 centimeters (55-65 inches) in California by 2100," rather than citing the range. [11]

An approach, intentional or not, that leads to planning focused primarily or exclusively on the highest possible SLR estimate in the NRC report clearly strays from the stated goal of the DG of using "best available science."

Recommendation: The projections from the NRC Report should be added to the DG in all places where SLR figures from the Report are cited in the DG. The relative meaning of the projections and the ranges should be presented in the DG to help achieve clarity and transparency.

Comment 2: The Draft Guidance rigidly relies on a single report while ignoring all other credible science.

There is tremendous uncertainty associated with climate change. This uncertainty relates not to the *fact* of climate change, on which there is virtually no doubt within scientific circles, but to the *nature* and *scope* of climate change's secondary effects such as SLR. New projections are emerging regularly, models are getting more complex and improving, and observations are accumulating. In such a dynamic environment, decision-makers are regularly cautioned by climate scientists and science translation professionals to never rely upon a single source of information, be it a single climate model or a single expert.

In general, the DG appears to approach the use of best available science in a highly rigid manner. It appears to consider the NRC Report the single, exclusive, authoritative source of information on SLR, when in fact there are numerous authoritative sources in addition to NRC that decision-makers (and the Commission) can and should consider when assessing vulnerabilities and risk, making planning decisions, and funding adaptation efforts. The Commission's guidance appropriately advocates the use of "best available science" at the time of publication. However, the Final Guidance document should also recognize that other sources of SLR projections exist now, or may be available in the near future, and the guidance document should allow local governments to rely on those sources, in part or in full, *provided* those sources are peer-reviewed, widely accepted within the scientific community, and locally relevant.

The most highly respected climate science body is the Nobel Prize-winning Intergovernmental Panel on Climate Change (IPCC). The IPCC's 5th Assessment Report (Working Group I) (AR5) was released in September, 2013, just a few weeks before the DG was released, and so we

[11] DG, p. 3. (This appears to be an errata: it's unclear where these figures appear, but the high end in NRC for net sea level rise is 167 or 166 cm for Los Angeles and San Francisco, respectively, rather than 165 cm).

understand why this report could not be incorporated into the DG. We recommend the AR5 SLR figures be incorporated into the final Guidance. Arriving over a year after the NRC report, which relied extensively on the IPCC's long-superseded 2007 4th Assessment Report, AR5 represents a 2013 consensus snapshot of the international climate science community findings on climate change, including global sea level rise. The AR5 report provides a somewhat different range of scientific opinion than the NRC Report. The IPCC projected SLR globally for the year 2100 at 11-39" overall and 21-39" under RCP 8.5 (the worst case emissions scenario).[12] This contrasts with the global SLR figures in the NRC Report of 20-55" in 2100 .[13] The NRC high end numbers are approximately 45% higher than the IPCC's.

The IPCC made the following statement explaining why it rejected estimating global SLR higher than 39" in 2100 (the top of the "assessed *likely* range" referenced below are the 21-39" projections for 2100):

> The basis for higher projections of global mean sea level rise in the 21st century has been considered and it has been concluded that there is currently insufficient evidence to evaluate the probability of specific levels above the assessed *likely* range. Many semi-empirical model projections of global mean sea level rise are higher than process-based model projections (up to about twice as large), but there is no consensus in the scientific community about their reliability and there is thus *low confidence* in their projections. (emphasis in original) [14]

It appears from the DG that local governments may be directed to ignore this and other relevant science in the development of LCPs and CDPs, and we believe such an approach unwise and not reflective of the DG stated goals of encouraging the use of "best available science."

Another major sea level rise report came out in December 2012 from the National Climate Assessment, about six months after the NRC Report.[15] The National Climate Assessment (NCA) is a massive, national study mandated by Congress as a state-of-the-art assessment of the nation's vulnerability to climate change. The NCA presents four SLR scenarios for planners to consider, including for 2100 a low of 8" and a high of 79", and two intermediate levels of 19" and 47" that are more likely, built largely upon different land ice assumptions [16]

The DG only selectively discusses the NCA findings, which pre-dated the DG, and does not substantively touch upon the AR5 science conclusions, which were released in final form just

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[12] *Climate Change 2013: The Physical Science Basis. Working Group 1 Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Summary for Policymakers.* 2013. p. 23-24. Intergovernmental Panel on Climate Change. Figures are relative to 1986-2005, while NRC Report figures are against a baseline of 2000.
[13] NRC Report, Table 5.2, p. 89.
[14] IPCC, op cit, p. 24.
[15] Parris, A., et al. *Global Sea Level Rise Scenarios for the United States National Climate Assessment*, December 6, 2012, produced for NOAA, USGS, SERDP and USACE.
[16] Ibid, p. 2.

prior to the DG. Figure 1 presents the low and high bounds and most likely SLR scenarios from the NCA, IPCC, and NRC Report.

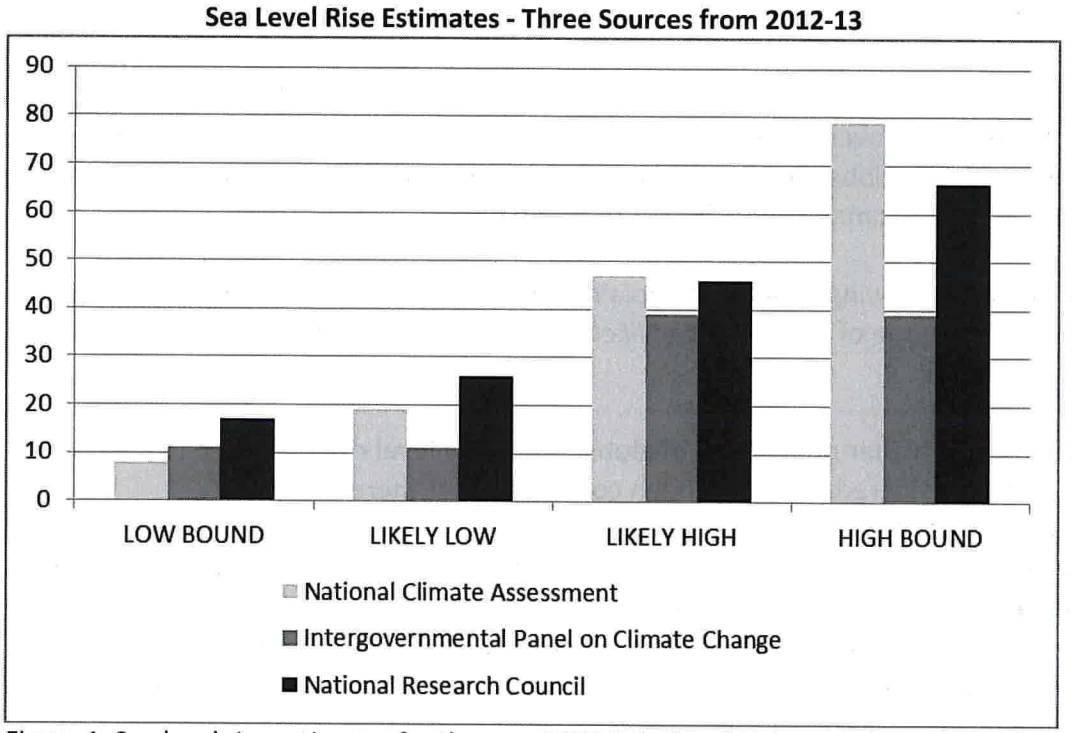

Figure 1. Sea level rise estimates for the year 2100 in inches for three major reports. Low and High Bound refers to extreme ends of each estimate, while "Likely Low" and "Likely High" as used here refers to estimates that don't require assumptions of worst case SLR conditions not considered likely to occur or highly successful GHG emission controls that also appear unlikely. For IPCC, the bounds and likely ranges are the same, as IPCC did not present extremes for which they found "insufficient evidence." For NRC, the likely low and high figures represent the one standard deviation, or confidence intervals, associated with the projection figures in the NRC Report.

It is unclear from the language in the DG the degree to which the Commission is proposing to limit the use of peer-reviewed climate science on the part of Californians updating or applying for LCPs or CDPs. In some places, it appears the intent is to exclude sources other than the NRC, for example:

> The 2012 NRC Report is the best available science on California's regional sea-level rise, and it should be used when sea-level rise projections are needed. [17]

In other places, the DG states this document is but one among many sources that may be consulted in conducting assessment and planning adaptation:

[17] NRC Report, p. 119.

> Use range of SLR scenarios based on best available science (e.g. NRC Sea Level Rise Report).[18]
>
> Using the NRC report or other comparable study, determine the range of sea-level rise for the planning horizons of concern.[19]

And finally, elsewhere the intent is ambiguous:

> The best available science should be used in planning and regulatory actions. . . This science may include peer-reviewed and well-documented climate science, adaptation strategies, and management practices. At the time of this report's publication, the best available science on sea-level rise in California is the 2012 National Research Council (NRC) Report, *Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present and Future* (NRC, 2012)" (underlined emphasis added). [20]

While the IPCC and NCA represent two of the most eminent international and domestic entities, there are other sources that may be worth the Commission's (and decision-maker) consideration. One recent peer-reviewed survey demonstrates that the range presented in the NRC Report and the DG does not represent consensus opinion in the scientific community on likely SLR. Lead author Benjamin Horton (a co-author of the NRC Report) and co-authors including Stefan Rahmstorf compiled survey responses about future sea level rise from 90 of the top published SLR experts in the world. The "median likely ranges" from this expert sample provided a range of 0.7-1.2 meters (28-47") of SLR by 2100 under RCP 8.5, the highest emissions scenario.[21] These figures are strikingly similar to the findings in NRC, IPCC, and NCA for the most likely SLR levels for 2100 (see Figure 2).

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[18] DG, Figure 1, p. 8 and Figure 2, p. 11.
[19] DG, p. 38
[20] DG, p. 22.
[21] Benjamin P. Horton, Ramstorf, S, Engelhart, S, and Kemp, A. *Expert assessment of sea-level rise by AD 2100 and AD 2300*, Quarternary Science Reviews 84 (2014) 1-6.

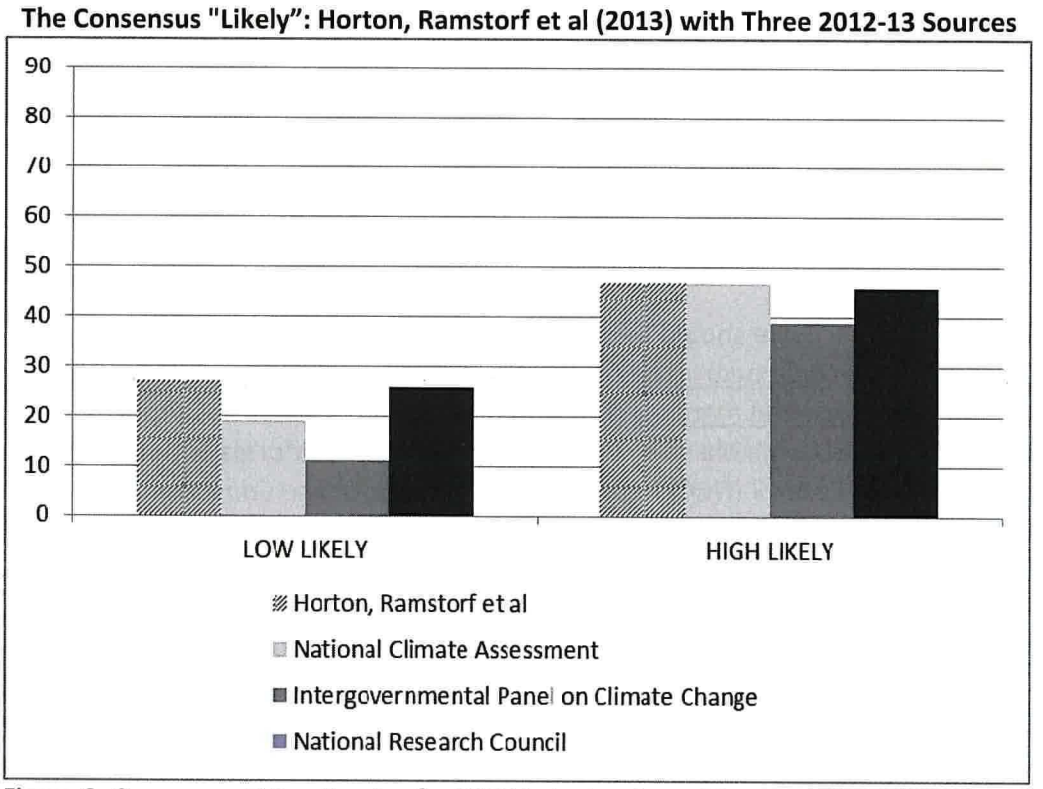

Figure 2. Consensus SLR estimates for 2100 in inches from 90 peer-reviewed published SLR scientists, as reported in Horton, Rahmstorf (2013), compared to likely figures from three prominent estimates as also shown in Figure 1.

<u>Recommendation</u>: The Draft Guidance should be revised wherever best available science is discussed to provide greater flexibility to local governments to use the latest peer-reviewed science and broad scientific agreement as to likelihood and the expected scope and timing of sea level rise. The conclusions of both the IPCC and the NCA should be presented in context in the Guidance alongside the NRC Report conclusions.

<u>Comment 3: Vertical land motion guidance fails to consider local conditions by requiring a one-size-fits-all set of assumptions for the area from Cape Mendocino to the Mexican border.</u>

The DG states in several places that an assessment of SLR vulnerability requires an understanding of local conditions. Embedded in the ranges from the NRC Report that are the basis of the DG, however, are vertical land motion (VLM) projections which are acknowledged in the DG to NOT consider local conditions:

> The NRC Report has adjusted regional sea level projections for the large-scale uplift and subsidence that has been observed along the coast. However, the NRC

> projections have not taken into account the local variations in vertical land motion that occur.[22]

Vertical land motion for the area south of Cape Mendocino is estimated in the NRC Report at 0.4 – 5.5" for 2050 and 1-11" for 2100.[23] The upper end of these ranges are used to derive the upper end of the overall ranges for relative SLR (so 5.5" of VLM makes up about 23% of the 24" high end 2050 SLR figure, and 11" of VLM comprises 17% of the 66" high end 2100 SLR figure). These are non-trivial components of the overall ranges.

The DG requires local governments in the Cape Mendocino to Crescent City area to revise these projections to accurately reflect local conditions. Other regions, however, are strongly discouraged from evaluating local conditions to identify an appropriate projection.[24] This precludes the possibility that other regions may have the ability to produce credible VLM projections that accomplish what the NRC Report did not seek to accomplish – accurate local conditions.[25] In fact, the NRC Report Committee broke down the coast line examined in the report in broad swaths only because its time and resources were too limited to provide finer scale detail, not because it judged that finer scale detail was unobtainable.[26]

<u>Recommendation</u>: Sections of the DG that appear to discourage or prohibit local government from developing local vertical land motion estimates appropriate to their jurisdiction should be removed.

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[22] DG, p. 127.
[23] NRC Report, Table 5.3, p. 96
[24] DG, p. 39: "Adjustments for vertical land motion are not recommended for other locations." p. 126: "For all other areas, this step can be skipped." p. 128: "When local vertical land motions are used to modify the regional sea-level rise projections, there should be at least one scenario that examines the consequences from the unmodified regional sea-level rise range."
[25] The DG in two places, p. 127 and in footnote 19 on p. 39, cites a statement in Appendix B of the State Guidance, the response to questions for a panel of NRC Report authors in which those authors state: "We do not believe that there is enough certainty in the sea-level rise projections nor is there a strong scientific rationale for specifying specific sea-level rise values at individual locations along California's coastline." The DG interprets this sentence to admonish localities to not attempt to determine local VLM except for that between Cape Mendocino and Crescent City. We believe this interpretation of Appendix B in the State Guidance is incorrect. The sentence cited in the DG most significantly addresses the question of differentiating sea level rise along different parts of the coast, not VLM. While much of Appendix B has a "reading tea leaves" quality to it, a close reading of the text that follows the sentence cited in the DG reveals that the supporting arguments are primarily about SLR, not VLM.

Of great interest are these sentences on pg. 11, which also happens to support our Comment 1:
"We believe that using a single sea-level rise value is the [sic] presently the best and most tractable approach… Table 5.2 in the NRC report [this reference is actually to Table 5.3] projects essentially identical values for both San Francisco and Los Angeles for 2030 (14.4-14.7 +/- 5 cm), 2050 (28-28.4 +/- 9.1 cm), and 2100 (91.0-93.1 +/ 25 cm)."

First, these figures are most significantly about SLR, not VLM. And to reiterate the point related to our Comment 1, the scientific panel chose to use the "projections" from Table 5.3 in pinpointing expected SLR up and down the coast -- not the bounding ranges.
[26] Personal Communication, Tad Pfeffer (NRC Report co-author)

Thank you again for the opportunity to comment. We look forward to working with the Coastal Commission in the continued development of this important Guidance and in all our work together to protect our priceless coastline.

In discussions with other interested parties regarding this Guidance, it has been suggested that it might be useful before finalizing the Guidance to convene a meeting or workshop of some kind featuring sea level rise scientists, Coastal Commission and other state agency staff, and decision-makers working on assessing and adapting to the effects of sea level rise. Talking through the complex and often conflicting meaning of all these scientific sources, their regulatory and permitting implications, and the largely uncharted territory of adaptation design, would in our view be a valuable conversation prior to finalization. The San Francisco Public Utilities Commission would be happy to assist in convening such a meeting if the Sea-Level Rise Working Group were interested.

If you have any questions regarding these comments, please contact me at [redacted] and [redacted].

Thank you for your consideration of these comments.

Sincerely,

[redacted]

David Behar
Climate Program Director